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parallel to it from Danzig to Stettin, and thence *via* the Trebel to the Baltic near Ribnitz. Some parts of this marginal water course were fluvial and some lacustrine, the largest lake being about Stettin. These lakes are described in detail. For the largest three distinct levels are made out, the highest of which is 25 meters above sea level. These stages are connected with the retreat of the ice, and the opening of new outlets. The development of the present Baltic drainage is described in great detail. Many of the north-south valley now draining to the Baltic are thought to have been originally subglacial valleys draining south to the marginal valley last mentioned before the ice melted away. The drainage through them was then reversed.

Between the fourth halting place of the ice and the Baltic Sea Keilhack makes out and maps eleven substages in the recession of the ice, each changing in some recognizable way, the drainage of the preceding stage. These subordinate stages, like the larger ones, show that the ice did not retreat at the same rate all along its front. So detailed a piece of work concerning drainage along the margin of the ice has not before been published.

One of the interesting facts brought out in this paper is the similarity of the phenomena of the last glacial epoch in Germany with those of the corresponding epoch in the United States. In the Wisconsin epoch the edge of the ice made several halts in its recession from its position of maximum advance. In each of these positions morainic belts were developed, and as in Germany the strongest of these belts was not at the position of maximum advance, but in a more northerly position. As in Germany, each morainic belt is bordered by sand plains. As in Germany, the recession of the edge was unequal, and here as there, the locations of one stage did not correspond with those of another. The analogies might be carried much further, but not to the drainage from the ice, since similar topographic relations did not exist in the United States.

R. D. S.

Shore Line Topography. By F. P. GULLIVER. Proc. Am. Acad. of Arts and Sciences, Jan. 1899. pp. 151-258.

In this essay Mr. Gulliver presents the mature results of a very serious piece of work. The topography of shore lines is considered under *initial* forms and *sequential* forms. Under initial forms are

included those which shore action has not modified since the region concerned was uplifted or depressed (relative to the surface of the sea). Under sequential forms are included those features which are developed subsequent to the diastrophic change, by the forces at work along the shore. The larger part of the essay is naturally devoted to sequential forms.

The reading of this essay makes several things evident. In the first place, Mr. Gulliver has exhausted the literature on the subject with which he deals; and, in the second place, he has made diligent use of maps. In the use of this material he has gathered a large body of facts which he has attempted to interpret and classify. Not only this, but he has attempted to interpret and classify them *in terms of development*, so as to put the topography of shore lines on an equal footing with the topography of land surfaces, as an index of geographic evolution. So far as we are aware, this is the first time this task has been essayed, and the author is to be congratulated on the successful outcome of his study. Geography and geology are the gainers, and the future student of coast lines will hardly fail to consult this essay.

In the author's own words, the thesis of the essay is the following: "The forms of any coastal belt may be grouped in the appropriate stages of a cycle. These forms will be consistently related to the associated land area on the one hand, and to the sea bottom on the other. When considered together, the forms of a coastal belt indicate the relative time since the last considerable uplift or depression, as well as the ratio existing between the several activities, in their dynamic effect upon the forms of the coast and the shore." The whole essay is the expansion of this idea.

In consonance with this mode of treatment of the subject, the author has made use of many of the life terms, such as infancy, youth, adolescence, maturity, etc., which are now in use in connection with the history of rivers. Some of these terms have a new meaning when applied to coast lines, and their adoption will be at the cost of some mental effort. At the outset it will be necessary to stop to think what the terms mean in connection with coast lines, as distinct from what they mean when applied to land surfaces in general. This, however, is no serious objection to their use. On the first reading of the essay, it must be confessed that the use of biological terms sometimes seems a little forced. Such objections as may be entered to their use will be

charged to old-fogyism by those who like to see the old terms used in the new way, and to conservatism by others. The reviewer is prepared to go a good ways in the application of biological terms to geographic evolution, where the terms fit, but when a large and quickly built delta is called a "precocious infant" (p. 224), it seems to be going a trifle far. Such criticism is, however, on the surface of things; it touches nothing fundamental. Some new terms are introduced to designate forms which have been nameless, and some of them are so good and so much needed that they should be adopted at once. An example is "wave-base" (p. 176) to denote the plane to which waves may degrade the bottom in shallow water. It is the correlative of base level. Some other terms, however, do not at first seem so necessary or so happily chosen. To this class belongs "winged beheadland" to denote a sea cliff with a spit on either side (p. 213).

There are not a few minor points in the essay which might be criticised, but it seems almost ungracious to mention them in the presence of so many larger matters which deserve hearty commendation. Glacial erosion seems not to have due recognition among the agencies which shape shore lines. It is true that the author expressly disclaims his intention of discussing this point, and it is true that glacial modification of coasts are accidental, in the sense of not being a part of the normal cycle which is the theme under discussion, but it might have been well to recognize more fully the effects of glaciation in connection with some of the coasts referred to, even though the subject of glacial modification of coast lines is not discussed. The writers on Lake Agassiz are gently criticised for describing the shore lines of that lake as if they "were formed once for all and would forever remain as constructed" (p. 187), but the truth is, these shore lines are still sensibly as constructed, and no one has essayed to write up the history of the changes which these shores will yet undergo. It will be readily seen that when such minor points are the things which suggest themselves for criticism the essay as a whole is strong.

Not only is the essay a serious piece of work, as suggested at the outset, but, by means of the numerous references, both cartographic and textual, the author has placed the material on which he based his conclusions at the command of future students. From this material students may draw their own conclusions, and, judging from the tone of the essay, no one would be more ready to entertain alternative conclusions than Mr. Gulliver himself.

R. D. S.